# Mobility and feeding strategies in the pastoral systems of the Syrian *Badiah*

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**SUMMARY –** The pastoral system of Syria, like most of West Asia and North Africa, is under stress with growing sheep population and continuous degradation of the rangelands. While the research and development society is strongly promoting community rangeland management in a participative and collaborative way, it is essential to characterize and assess the level of dependence the Bedouins are having today with regard to their community rangelands. Using information related to animal mobility and feeding patterns of 313 Bedouin households and their respective community characteristics, we identified 5 strategy types and in a second step explained the probability for a household to adopt one strategy over another. Results show the strong role of community characteristics in determining those choices and in particular the relationship with the cropping zone.

**Keywords:** Pastoral systems, animal mobility, production strategies, Syria.

***RESUME –*** *"Mobilité et stratégies d'alimentation dans les systèmes pastoraux de la région de Badiah, Syrie". Le système pastoral syrien, comme la plupart des systèmes de l'Asie de l'Ouest et de l'Afrique du Nord fait face à de fortes pressions avec la croissance des effectifs ovins et la continuelle dégradation des parcours. Alors que les acteurs de la recherche et du développement promeuvent une gestion communautaire des parcours selon une approche participative et collaborative, il est essentiel de caractériser et d'estimer le niveau de dépendance que les populations Bédouines ont aujourd'hui vis-à-vis des parcours de leur site d'attache. En nous basant sur des informations relatives aux stratégies de mobilité et de régime alimentaire des troupeaux de 313 ménages Bédouins, ainsi que sur les caractéristiques de leurs communautés, nous identifions 5 types de stratégies et proposons dans un second temps d'expliquer la probabilité pour un ménage d'adopter une stratégie plutôt qu'une autre. Les résultats montrent le rôle important que jouent les caractéristiques communautaires dans la détermination des choix et en particulier la relation qu'elles entretiennent avec la zone agricole.*

***Mots-clés:*** *Systèmes pastoraux, mobilité animale, stratégies de production, Syrie.*

## The *Badiah* system in transformation

Over the past several decades, livestock production systems in the Syrian steppe, the *Badiah*[1], have been the object of great transformations. This can be linked to: (i) the degradation of the steppe, (ii) the increased sheep population (tripled since 1960 reaching more than 15 millions head by the year 2000; Vercueil and Cummins, 2003), (iii) the social transformations as well as (iv) a succession of public interventions (Ngaido *et al*., 2001). Interventions furthering variable goals from the promotion of Bedouins settlement through the development of cultivation in the 1950-70's, the implementation of feed subsidies program and state reserves in the 1980's, to the ban of cultivation in 1992 on the rangelands located in the rainfall zone of less than 200mm. The most perceivable impact of this last measure is the increased use of supplementary feeding and the growing dependence vis-à-vis the cropping zone where flocks are sent several months per year to graze crop residues. However, we can expect that this restrictive measure did not affect the Bedouins' production strategies at the same degree. Herders belonging to communities which used to cultivate large areas should be the ones having to adapt the most in their mobility and feeding patterns.

[1] The Badiah is defined as the rangelands which receive on average of less than 200 mm of annual rainfall. The zone located in the eastern part of Syria represents 51% of the national territory.

In order to better understand the pastoral system in its complexity and assess the current rangeland management of Bedouin communities, and the production strategies of the pastoralists, a survey was conducted in spring 2005 by the International Center for Agronomic Research in Dry Areas (ICARDA) and the Ministry of Agriculture of Syria in six of the seven provinces of the Syrian *Badiah*[2]. The sampling method consisted in three steps: (i) twenty five "mother communities" were randomly chosen among the 125 officially censed in the steppe; (ii) two communities were then randomly selected among the communities composing the mother community; (iii) a sample of household was chosen to be the most representative of the community under three criteria (flock size, tribal sub group and average feed cost per ewe), which consisted of a sample of 313 households representative at the Badiah level. Multiple survey instruments consisted of: (i) a participative mapping of the community rangelands locating the main types of rangeland; (ii) a vegetation characterization of each rangeland type; (iii) a socio-economic survey at the community level; and (iv) a household survey collecting information on livestock production and mobility strategies.

We present in this paper an up to date characterization of the Bedouin strategies with the main objective to better understand the underlying incentives for better rangeland management. Also, we are looking at Bedouin behaviour from a community angle as we are interested in better assessing the level of dependence of their flocks to the rangeland resources. After identifying the main strategies prevailing today in the Syrian *Badiah*, we estimate in a second step the determinants of adopting one of the strategies.

## Feeding and mobility strategies

Before the introduction of hand feeding in the mid-20th century, the mobility pattern of the pastoralists was perfectly associated with the pastoral resources (forage and water) accessibility and availability. Today, animal mobility is less but still strongly associated with forage availability. In spring herders are mainly grazing on their community land. We observe some Bedouin flocks grazing on neighbouring community land, in government reserves or in other sites in the *Badiah*, but this practice is limited. The herders are then moving to the cropping zone at the beginning of summer to provide crop residues to their flock on rented or privately owned lands. In fall, either the flocks stay on cotton residues or go back home and are provided supplemental feed. During the 3 months of winter (December-February), the flocks' diet is fully composed of concentrate and straw. The generalization of hand feeding and the apparition of trucks and mobile cisterns led to a change in the mobility pattern and grazing availability. Today some Bedouin households spend the entire year in the steppe and others in the cropping zone.

In order to tackle the issue of community range management, herders' strategies vis-à-vis the use of their home rangelands need to be understood. We made the hypothesis that herders in the steppe could be classified by looking at two variables: the mobility and feeding patterns. Regarding the mobility strategies, we considered a long enough period to include climatic variability between years and short enough for the information to be recalled by the interviewees. In our case, the 1999-2004 period fit these criteria with 2 bad years (1999 and 2000), three medium years (2001, 2002 and 2004) and a very good year (2003). We then looked at the frequency the herders were using the site and the number of months spent on the site. Regarding the feeding strategy, we isolated herders with a more intensive production system since this category could be considered as less dependant on the range resources. Intensification (defined in our case as the propensity for a flock to depend on hand feeding mostly concentrate feeds) is a relatively continuous process, and the segregation process is not obvious. Moreover, we separated as a group herders who supplement their flocks in spring while the rangelands are the most productive.

We identified five distinct types of mobility and feeding strategies:

(i) The opportunists come on the community site certain years only when forage is sufficiently abundant on the pasture for the community. Therefore they are the herders depending the least on community pastures. We can expect that this category is underestimated in our sample, since the year of the survey was a poor rainfall year and most of the opportunistic herders stayed in the cropping zone.

[2] Aleppo, Hama, Homs, Raqqa, Deir Ezzor and Damascus.

(ii) The regular herders use the community rangelands every year, but only for a certain period since they practice regular moves between the *Badiah* and the cropping zone (2 "round trip" per year on average).

(iii) The less mobiles are the herders grazing on their rangeland site every year and spending the whole year in their community at least once in the past 6 years.

(iv) The sedentary herders are the settled herders who did not move from their site, even during dry seasons and during dry years.

(v) Finally, we selected households from all these to form a fifth group called "intensive" who are the herders who used supplementary feeding in April 2004, while grazing was at its best, also this group of Bedouins does not fall in a particular mobility category described above. The discriminant variable of spring supplementation appears to be a good indicator of the most intensified production system (Table 1) which are those herders who have higher production costs and the most productive flocks. In addition, during normal rainfall years they are, with the regular herders, the ones relying the least on range grazing (approximately 20% of total forage needs from grazing rangeland).

Because the main input in this extensive production system is common property forage (community rangelands), we expect that the household strategies are interconnected among the herders of the same community. The last section of the table 2 shows in fact that the mobility categories are strongly correlated to the indicators of mobility built at the community level. We can see that the less mobile and sedentary herders belong to communities with higher household presence on average compared to the opportunists and regulars who belong to communities populated at 40% of its potential. The coefficient of variation of the population presence in the community over the past 6 years is very low (high) in communities where immobile (opportunistic) herders belong. Finally there is no apparent connection between the community mobility pattern and the intensive herders. This last category can be found in communities with the highest percentage of herders fattening their lambs .

## The determinants of herders' strategies in the *Badiah*

In order to better understand the strategy of the Bedouin households, the probability for a household to fall under one of the five categories was estimated using a multinomial logit model based on the households and their community characteristics. The variables introduced in the model are the ones described below in Table 2. They are related to the household characteristics (age of the household head, household composition, human capital) responding to hypothesis based on microeconomic producer theory. We then introduced other variables referring to individual and collective endowment (absolute and relative flock size relative to the average flock size in the community, possession of water tanks) and to transaction costs (distance to markets and to water points). Three variables related to pressure are introduced (potential household density, the ability to protect community grazing from outsiders, and the density of outsiders flocks in 2004). Other variables refer to the relation with the cropping zone (as an external grazing option), and finally the percentage of community land previously cultivated is used in order to measure the impact of the ban on cultivation.

The main results of the model (Saint-Macary, 2005) are synthesized in the right hand side of Table 2. The probability to be an opportunist is higher for households owning flocks smaller than the community average, belonging to communities which have more difficulty to exclude outsiders, and are distant from the cropping zone. In addition, opportunist herders are distinguished from the less mobile and the intensive ones by owning some plots in the cropping zone. A low education rate in the family and belonging to a community located near to the cropping zone increases the probability to be a regular herder. The probability to adopt a regular mobility strategy versus a less mobile or sedentary one depends on the percentage of land that was previously cultivated. The less mobile households are distinguished from the regular and intensive households by the high external animal pressure and the low percentage of previously cultivated land in the community. The probability to fall under the sedentary category decreases and then increases with the age of the household head (the youngest and oldest are the less mobile) and increases with the presence of women in the household. Even though the descriptive statistics show the small flock holdings of this household category, the

relationship does not emerge in the model. Sedentary households have less opportunity offered in the cropping zone as they are located relatively far from the *Badiah* line and have less community networking in the cropping zone. Of the intensive herders, the sedentary ones have better access to water points and are settled not far from a town. The intensive households own larger flocks than the community average and belong to communities with a low potential household density.

Table 1. Five categories of herders in the Syria *Badiah* and the characteristics of each

| | Opportunist | Regular | Less mobile | Sedentary | Intensive |
|---|---|---|---|---|---|
| Number of households | 31 | 75 | 106 | 41 | 60 |
| Mobility pattern, 1999-2004 | | | | | |
| Total no. of months on site in past 6 years | 25.4* | 32.2* | 51.5* | 72* | 42.0 |
| Coefficient of variation in length of residence | 0.51* | 0.06* | 0.28* | 0* | 0.18 |
| No. of months on site in 1999 (low-rainfall year) | 2.8* | 4.3* | 6.7 | 12* | 5.1* |
| No. of months on site in 2004 (medium-rainfall year) | 7.8 | 5.9* | 9.8* | 12* | 8.9 |
| Total no. of moves in past 6 years | 4.0* | 11.7* | 6.3 | 0* | 7.5 |
| Feeding strategies, 2004 | | | | | |
| Concentrate use (%) | 46.8 | 33.8* | 44.7 | 49.5* | 49.8* |
| Crop residue use (%) | 16.9* | 46.8* | 22.5* | 18.1* | 27.4 |
| Grazing on community rangeland (%) | 36.3* | 19.4* | 32.8* | 32.4 | 22.8* |
| Productivity indicators, 2004 | | | | | |
| Productivity index† | 0.46 | 0.43* | 0.48 | 0.48 | 0.50 |
| Total production cost per ewe (SP) †† | 2142 | 2155 | 1834 | 1623 | 2412* |
| Lambs fattened (%) | 33 | 42 | 40 | 22* | 54* |
| Community-level mobility and fattening patterns, 1999-2004 | | | | | |
| Average 'herder presence'††† 1999-2004 | 0.40* | 0.43* | 0.56* | 0.59* | 0.53 |
| Variation in 'herder presence' 1999-2004 (coefficient of variation) | 0.66* | 0.41 | 0.42 | 0.37 | 0.39 |
| 'Herder presence' in 1999 (low-rainfall year) | 0.28* | 0.30* | 0.40 | 0.49* | 0.36 |
| 'Herder presence' in 2004 (medium-rainfall year) | 0.52* | 0.52* | 0.68* | 0.65 | 0.62 |
| Residents fattening their lambs (%) | 63.4 | 77.6 | 65.5 | 61.3 | 86.1* |

* Significantly different from all other means at the 5% probability level.

† Indicator of productivity obtained through a factor analysis from four variables (mortality rate, lambing rate, milk production per ewe and per year, percentage of ewes that gave birth to twins).

†† SP = Syrian pound; in 2005, 1US$ = 50 SP.

††† Indicator of use of community rangeland, calculated as (No. of households with sheep × months spent on community-rangeland site per year)/(total no. of households who use community-rangeland site × 12).

Because the structural characteristics of the community (distance of the community to the cropping zone, the nearest town or water points; internal and external demographic pressure) are playing an important role in explaining the mobility and feeding strategies of the Syrian Bedouins, the adoption processes rely more on constrained choices than on deliberate ones. This study shows therefore the importance of analysing the households within their community in this particular segmented society. Households belonging to communities which used to depend on barley cultivation before the ban, continue to strongly rely today on the cropping zone resources. However, they did not move their main residency location (as the opportunists) and keep a very regular mobility pattern between the two zones.

Table 2. Descriptive statistics of explicative variables and summary of results of the estimated model

| Description | Var† | Average value | | | | | Summary of estimation results†† | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Opp | Reg | LM | Imm | Int | Opp | Reg | LM | Imm | Int |
| Household characteristics | | | | | | | | | | | |
| Number of members in the household | H | 11.1 | 11.2 | 11.6 | 9.5 | 11.1 | | | | | |
| Age of household head | H | 51.3 | 53.5 | 50.4 | 49.3 | 50.1 | | | | -/+ | |
| % of adult woman in the household | H | 0.30 | 0.30 | 0.31 | 0.38 | 0.35 | | | | + | |
| % of member educated | H | 0.23 | 0.22 | 0.29 | 0.29 | 0.34 | | - | | | |
| Flock size | H | 232 | 191 | 280 | 86 | 265 | | | | | |
| Flock size relative to average flock size in the community | H | 1.06 | 1.82 | 1.41 | 0.55 | 2.12 | - | | | | + |
| Water access | | | | | | | | | | | |
| Distance to the closest water point in km | C | 9.35 | 8.19 | 3.99 | 6.20 | 3.15 | | | | - (OR) | - (OR) |
| Number of water tanks | H | 0.52 | 0.49 | 0.64 | 0.15 | 0.47 | | | | - | |
| Internal and external pressure | | | | | | | | | | | |
| Potential household density in the community ††† | C | 0.10 | 0.07 | 0.05 | 0.10 | 0.03 | | | | | - |
| Leader able to protect community borders+ | C | 0.16 | 0.43 | 0.43 | 0.46 | 0.37 | - | | | | |
| No. of outsiders animals grazing in the community (per ha) | C | 1.95 | 0.70 | 1.26 | 1.92 | 0.61 | | | + (RV) | | |
| Relation with cropping zone | | | | | | | | | | | |
| Distance to the *Badiah* line (km) | C | 63.6 | 22.3 | 49.9 | 48.4 | 46.7 | + | - | | + | |
| Community has members living in the cropping zone+ | C | 0.39 | 0.27 | 0.13 | 0.05 | 0.22 | | | | - | |
| Household own cropland in the cropping zone+ | H | 0.13 | 0.05 | 0.04 | 0.05 | 0.05 | + (LV) | | | | |
| Other variables | | | | | | | | | | | |
| % of area which was previously cropped | C | 0.31 | 0.60 | 0.38 | 0.40 | 0.45 | | + (LI) | - (RV) | | |
| Distance to the closest town (km) | C | 49.1 | 49.3 | 57.3 | 45.7 | 60.8 | | | | - | |

+ Indicates dummy variables.

† Level of variability: H = household; C = community.

†† A + or - sign without parenthesis indicates that the regression coefficients are statistically different for at least 3 out of the 4 multilogit equations, a + or - sign followed by a parenthesis indicates in the parenthesis to which equation the estimated coefficients are statistically significant: O = opportunist, R = regular, L = less mobile, I = sedentary, V = intensive.

†††Density indicator = total community members (migrants + residents) / total area of the community (ha).

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